EUROPEAN PATENT OFFICE

Patent Abstracts of Japan

PUBLICATION NUMBER : 10209744
PUBLICATION DATE : 07-08-98

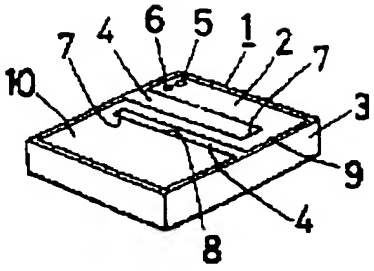
APPLICATION DATE : 28-01-97
APPLICATION NUMBER : 09013591

APPLICANT : MATSUSHITA ELECTRIC WORKS LTD;

INVENTOR : YAO HAJIME;

INT.CL. : H01Q 13/08 H01Q 9/04

TITLE : INVERTED F-TYPE ANTENNA



ABSTRACT : PROBLEM TO BE SOLVED: To adjust a resonance frequency by relatively varying the depth or circumferential length of a slit by removing part of a metal conductor at the outside side, facing the bottom part or side part of a slit formed in the metal conductor so as to an inverted F-type antenna of portable small-sized communication equipment.

SOLUTION: Two rectangular slits 4 are formed, so that the dielectric 3 of the center part of a metal conductor 2 is exposed from mutually different directions from the opposite external sides of the metal conductor 2 formed on a plate-type substrate of the dielectric 3. At a part facing the end part having a feed point 6 and a short-circuit point 5, a 1st removal part 9 of the metal conductor 2 facing the bottom part is removed by a fixed width from the external side to lower a resonance frequency at a certain rate. Further, a 2nd removal part 10 of the external side facing the side part 8 of the slit 4 is removed by a certain width in parallel to the external side for increasing the resonance frequency at a specific rate. Consequently, the resonance frequency can be adjusted easily, even after the metal conductor has been formed.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the small antenna used for small communication equipment, such as a carried type radio device, by carrying, and relates to the reverse female mold antenna which can adjust resonance frequency easily especially.
[0002]
[Description of the Prior Art] In recent years, utilization of the communication equipment using the frequency of a microwave band, a semi- microwave band, etc. progresses, and a small antenna has come to be used widely. Especially the spread of carried type radio devices is remarkable, and in order to fill the demand of the further formation of small lightweight, a reverse female mold antenna as shown in drawing 6 has come to be used.
[0003] The above reverse female mold antennas 1 have the feeding point 6 and the too hastily connecting point 5, and although it is small and is lightweight, generally the frequency characteristic is a narrow-band, and the resonating resonance frequency has the feature decided by the size of a metallic conductor 2, the dielectric constant of a dielectric 3, etc.
[0004] moreover, the manufacture method that a printed wired board is usually used and the above-mentioned metallic conductor 2 manufactures a printed wired board as a dielectric 3 -- it fabricates and a dielectric 3 is made into the configuration of an antenna, and a metallic conductor 2 can be pasted up on the front face, or it can form by plating etc. and can manufacture
[0005] Moreover, the dielectric 3 which constitutes the above-mentioned reverse female mold antenna 1 There is variation in a dielectric constant with a manufacture lot, or the variation in the thickness of an antenna and a further Since the assembly variation by soldering at the time of assembling a metallic conductor 2 and an antenna etc. occurs and resonance frequency changes for every antenna individual Adjustment of resonance frequency was needed for every antenna individual, and resonance frequency was adjusted by removing a part of metallic conductor 2 which constitutes an antenna.
[0006]
[Problem(s) to be Solved by the Invention] However, according to the adjustment method of the above-mentioned conventional resonance frequency, change of the resonance frequency obtained by the method of removing a part of metallic conductor is only change to which frequency becomes high, and was not able to make resonance frequency low. Moreover, it needed to remove supervising change of resonance frequency and the method of removing a part of metallic conductor took the effort at tuning.
[0007] The place which this invention is made in view of the above situations, and is made into the purpose is offering the reverse female mold antenna which can raise, or lower and adjust resonance frequency easily, when after metallic-conductor formation of an antenna removes this metallic conductor.
[0008]
[Means for Solving the Problem] The reverse female mold antenna of invention concerning a claim 1 forms a metallic conductor 2 in the front face of a dielectric 3, and is characterized by enabling it to adjust the resonance frequency of an antenna low in the reverse female mold antenna which has at least one slit 4 in the metallic conductor 2 by removing the metallic conductor 2 of the outside side which counters the pars basilaris ossis occipitalis 7 of this slit 4.
[0009] The reverse female mold antenna of invention concerning a claim 2 is characterized by enabling it to adjust the resonance frequency of an antenna highly in the reverse female mold antenna of the claim 1 above-mentioned publication by removing the metallic conductor 2 of the outside side which counters the flank 8 of the above-mentioned slit 4.
[0010] The reverse female mold antenna of invention concerning a claim 3 is a reverse female

mold antenna characterized by for the metallic conductor 2 removed in the above-mentioned claim 1 and a reverse female mold antenna according to claim 2 in order to adjust the resonance frequency of an antenna having removed, and forming a mark 11 in a position more fixed than the outside side at the sections 9 and 10.

[0011] It is characterized by forming the reverse female mold antenna of invention concerning a claim 4 in the position which the mark 11 which the metallic conductor 2 removed and was formed in the sections 9 and 10 in the reverse female mold antenna of the claim 3 above-mentioned publication is the minute slit 12, and adjoined the outside side and which countered two sides mutually.

[0012] The reverse female mold antenna of invention concerning a claim 5 is characterized by forming the minute slit 13 intermittently in parallel with the outside side as a mark 11 in the above-mentioned claim 3 and a reverse female mold antenna according to claim 4.

[0013] the rear face in which the reverse female mold antenna of this invention formed the metallic conductor 2 in the front face of the dielectric 3 of a tabular, the feeding point 6 and the too hastily connecting point 5 were formed in one edge of the metallic conductor 2 which has the configuration where are the reverse female mold antenna which has at least one slit 4 in the metallic conductor 2, and the metallic conductor 2 was crooked by this slit 4, and has the this crooked configuration, and the metallic conductor 2 of the above-mentioned dielectric 3 was formed -- grounding -- the conductor is

[0014] The metallic conductor 2 removed in order to make low resonance frequency of the above-mentioned reverse female mold antenna is the side outside the metallic conductor 2 which countered the pars basilaris ossis occipitalis 7 of the above-mentioned slit 4, and becomes one edge of a metallic conductor 2 in which the above-mentioned feeding point 6 and the too hastily connecting point 5 are formed, and the portion which countered. By this 1st [the] removing and removing the section 9 by width of face more fixed than the outside side, resonance frequency can be reduced at a fixed rate.

[0015] Moreover, the metallic conductor 2 removed in order to make high resonance frequency of the above-mentioned reverse female mold antenna is the side outside the metallic conductor 2 which countered the flank 8 of the above-mentioned slit 4, and becomes the side outside the different other-end section from one edge of a metallic conductor 2 in which the above-mentioned feeding point 6 and the too hastily connecting point 5 are formed. By this 2nd [the] removing and removing the section 10 by width of face more fixed than the outside side, resonance frequency can be raised at a fixed rate.

[0016] as mentioned above, with the reverse female mold antenna of this invention Since the slit 4 is formed the place which must lengthen the metallic conductor 2 which usually constitutes the antenna in order to make resonance frequency low, By removing the portion which countered the edge of a metallic conductor 2 in which the above-mentioned feeding point 6 and the too hastily connecting point 5 are formed in the side outside the metallic conductor 2 which countered the pars basilaris ossis occipitalis 7 of a slit 4 The relative distance to the metallic conductor 2 from the place where the depth 4 of the relative slit 4 to a metallic conductor 2, i.e., a slit, is opened wide to a pars basilaris ossis occipitalis 7 can become long, and can make resonance frequency low.

[0017]

[Embodiments of the Invention] Hereafter, the operation gestalt of this invention is explained.

[0018] Drawing 1 is the perspective diagram of the reverse female mold antenna in which 1 operation gestalt of this invention is shown, and the enlarged view to which drawing 2 and drawing 3 expanded some reverse female mold antennas of drawing 1 , drawing 4 , and drawing 5 are the enlarged views to which some reverse female mold antennas in which other 1 operation gestalten are shown were expanded.

[0019] As shown in drawing 1 , the reverse female mold antenna of this invention The metallic conductor 2 formed in the front face at the substrate and this substrate of the tabular formed with

the dielectric 3, From a direction different more nearly mutually than the outside side which faces each other, it consists of two slits 4 formed so that the dielectric 3 of this metallic-conductor 2 center section might be exposed by the rectangle, and the feeding point 6 and the too hastily connecting point 5 which adjoined mutually one edge of the above-mentioned metallic conductor 2, and was formed in it.

[0020] it is ** formed of attachment or metal plating, the feeding point 6 and the too hastily connecting point 5 which were formed in the front face expose a metallic foil to a rear face through the dielectric 3 of a tabular, and the above-mentioned metallic conductor 2 is connected to a feeder and the grand board formed in a rear face, respectively

[0021] The above-mentioned antenna is called reverse female mold antenna by the arrangement configuration of an antenna, the feeding point 6, and the too hastily connecting point 5 which this metallic conductor 2 forms.

[0022] As shown in drawing 2 , two or more marks 11 at an interval [parallel to the portion which countered the edge in which the feeding point 6 and the too hastily connecting point 5 are formed in the outside side which countered the pars basilaris ossis occipitalis 7 of the slit 4 near the above-mentioned feeding point 6 the side outside the above and] more fixed than the outside side are formed in the above-mentioned metallic conductor 2. The 1st can remove the portion in which this mark 11 was formed, it can serve as the section 9, and resonance frequency can be reduced at a fixed rate by this 1st [the] removing and removing the section 9 by width of face more fixed than the outside side along with a mark 11.

[0023] Moreover, as shown in drawing 3 , the edge in which the above-mentioned feeding point 6 and the too hastily connecting point 5 are formed is the outside side which countered the different other-end section at the flank 8 of the above-mentioned slit 4, and two or more marks 11 at an parallel and interval more fixed than the outside side are formed in the above-mentioned metallic conductor 2 the outside [this] side. By the 2nd removing, and becoming the section 10, and this 2nd [the] removing, and removing the section 10 by width of face more fixed than the outside side along with a mark 11, the portion in which this mark 11 was formed is removed the account of a top, differ in the section 9, and can raise resonance frequency at a fixed rate.

[0024] The above-mentioned mark 11 was formed in the front face of a metallic conductor 2, processes what drew to the metallic conductor 2, and a metallic conductor 2, and is formed. In drawing 2 and drawing 3 , a dashed line is drawn to a metallic conductor 2, and it is formed in it.

[0025] Generally, the resonance frequency of a reverse female mold antenna is determined by the boundary length of a metallic conductor 2. However, resonance frequency changes in proportion to the boundary length of a metallic conductor 2, on the other hand, the reverse female mold antenna of this invention is in inverse proportion, as it is shown in the following examples, since the slit 4 is formed, and resonance frequency changes.

(Example) Resonance frequency of the reverse female mold antenna shown in drawing 1 was set to f0, and the variation of resonance frequency when removing a metallic conductor 2 for the distance to a mark 11 from the side as cut sizes L1 and L2 outside a metallic conductor 2 along with the mark 11 shown in drawing 2 and drawing 3 , respectively was measured.

[0026] Table 1 is the variation when setting resonance frequency f0 before the above-mentioned reverse female mold antenna 1 cuts to 800MHz, and Table 2 is the result of expressing the variation of resonance frequency f0, wavelength lambda 0, and a cut size.

[0029] As shown in the above-mentioned table 1 and Table 2, with the reverse female mold antenna 1 of this invention, resonance frequency can be quantitatively lowered by the 1st removing and removing the metallic conductor 2 of the section 9 quantitatively. Furthermore, resonance frequency can be quantitatively raised by the 2nd removing and removing the metallic conductor 2 of the section 10 quantitatively. In the above-mentioned example, although the property was evaluated using the reverse female mold antenna 1 of 800MHz of resonance frequency, in the width of face of a slit 4, the width of face of a metallic conductor 2, and a

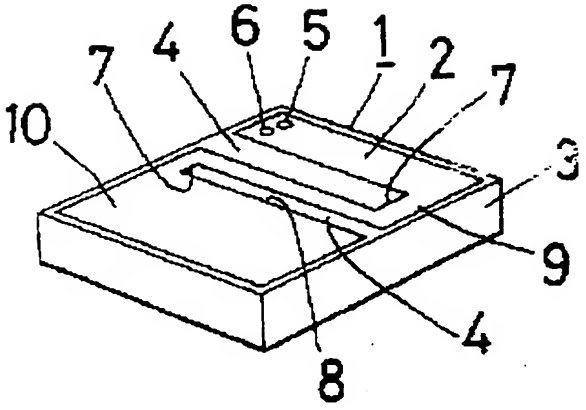


FIG. 1.

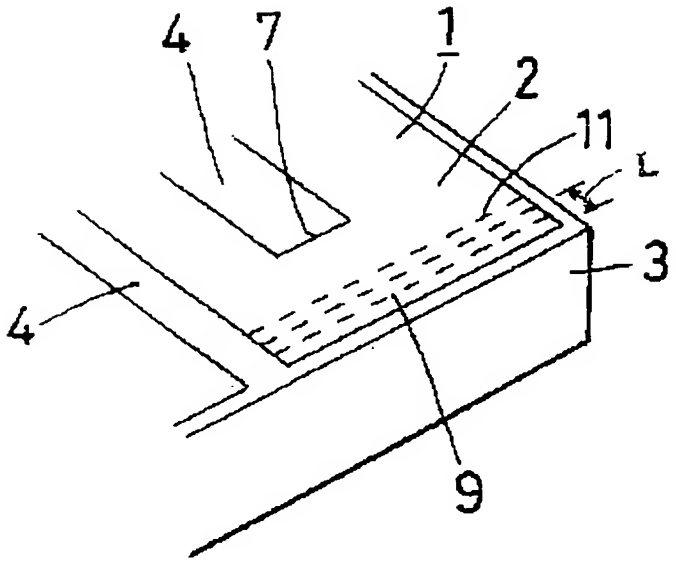


FIG.-2

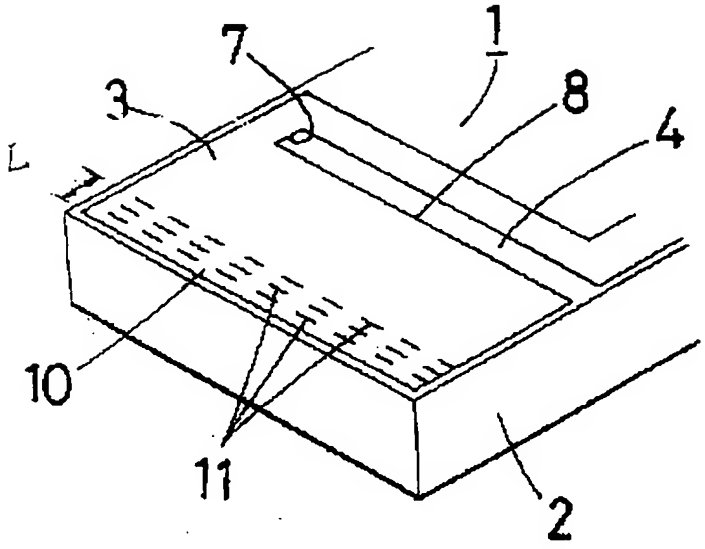


FIG. 2

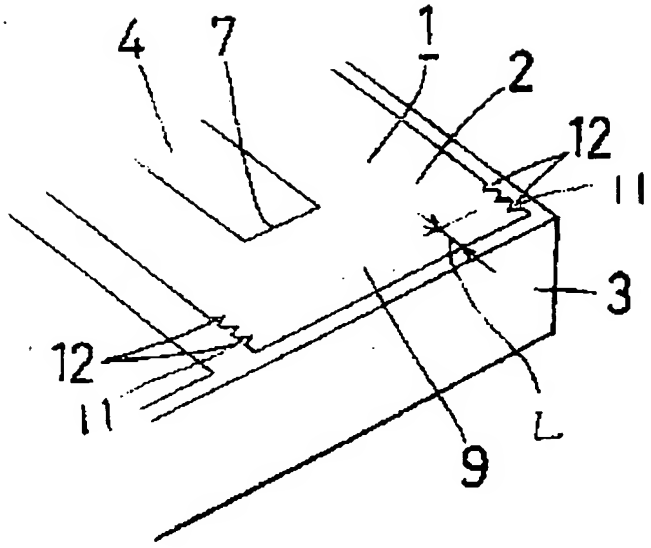


FIG. 4

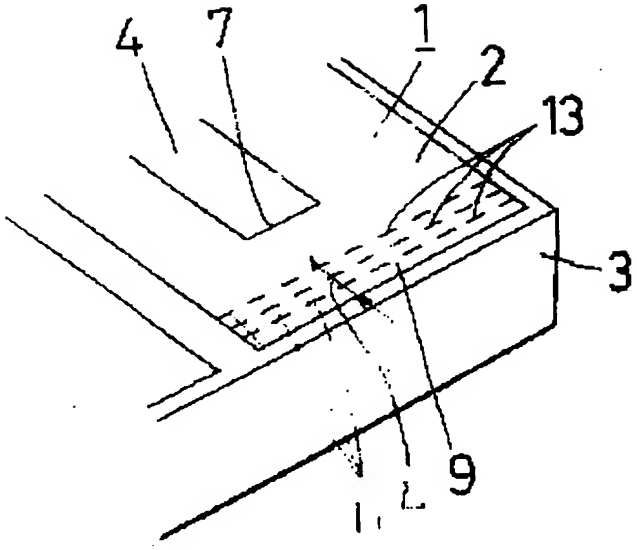


FIG. 5

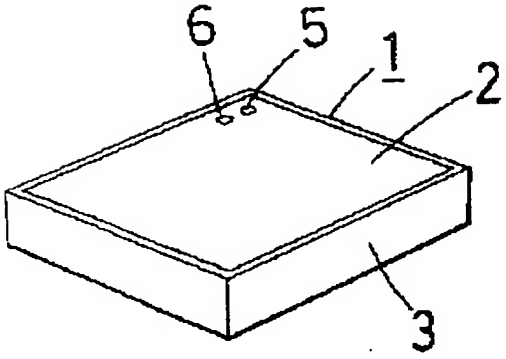


Fig.- 6

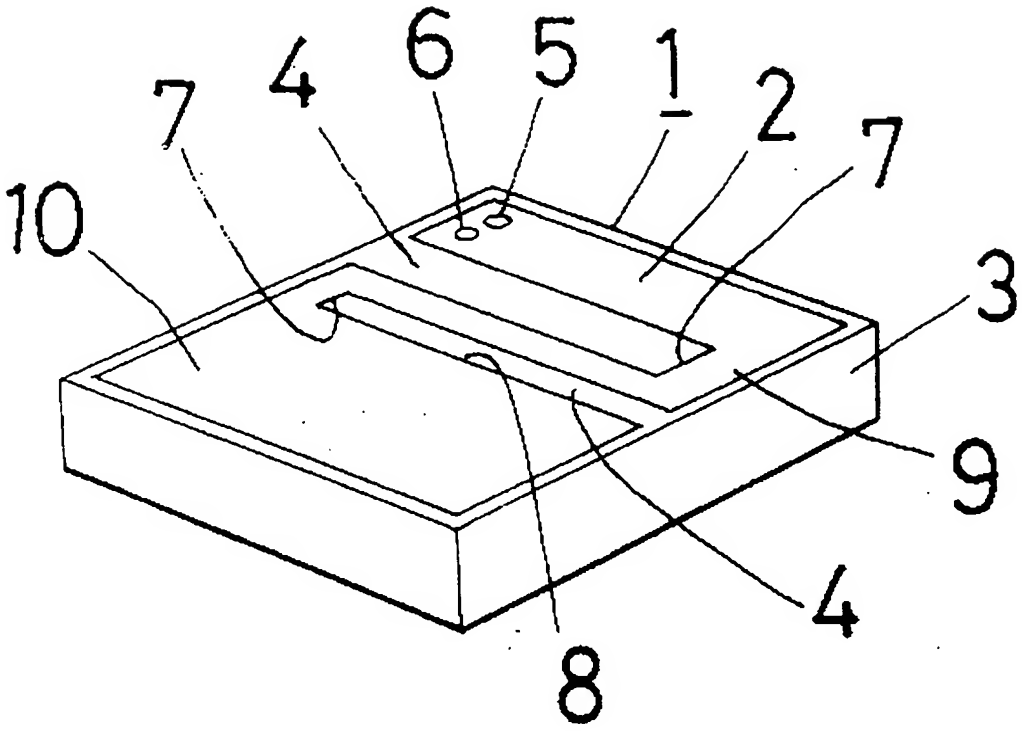
further. the above-mentioned variation changes with thickness of a metallic conductor 2. That is. the content concerning this invention is not limited to the above-mentioned example.
[0030] Moreover. drawing 4 and drawing 5 consist of minute slits 12 and 13 which 1 operation gestalt of the mark 11 which removes and is formed in the sections 9 and 10 is shown. the mark 11 processed the metallic conductor 2, was formed, removed a part of metallic conductor 2 the account of a top, and were formed. Drawing 4 forms the minute slit 12 in two sides which adjoined the outside side, respectively, is formed in the position where the minute slit 12 countered mutually. and displays the cut size L by connecting the pars basilaris ossis occipitalis of the minute slit 12 which countered.
[0031] Moreover, the minute slit 13 was formed intermittently, drawing 5 is formed in the outside side and parallel which this minute slit 13 adjoins, and the line which connected this minute slit 13 displays a cut size.
[0032] According to the reverse female mold antenna 1 of this invention. it becomes possible to lower resonance frequency easily or to raise it as mentioned above by removing the arbitrary portions of the metallic conductor 2 which constitutes an antenna.
[0033]
[Effect of the Invention] According to the reverse female mold antenna concerning the claim 1 of this invention, by removing the metallic conductor of the outside side which counters the pars basilaris ossis occipitalis of a slit, it becomes possible to adjust the depth of a relative slit. and resonance frequency of the antenna with which the metallic conductor was formed can be made low by removing a part of metallic conductor.
[0034] Moreover, according to the reverse female mold antenna concerning the claim 2 of this invention. by removing the metallic conductor of the outside side which counters the flank of the slit formed in the metallic conductor, the boundary length of an antenna can be shortened and resonance frequency of an antenna can be made high.
[0035] Moreover, since the minute slit which the metallic conductor removed in order to adjust the resonance frequency of an antenna according to the reverse female mold antenna concerning the claim 3 or claim 5 of this invention removed, and adjoined the section the outside side and which countered two sides mutually is prepared or the mark is prepared by the minute slit formed intermittently in parallel with the outside side, resonance frequency can be adjusted simply and quantitatively.
[0036] Thus. according to the reverse female mold antenna of this invention, after forming a metallic conductor, resonance frequency can be raised, or it can be made low, or can adjust quantitatively.

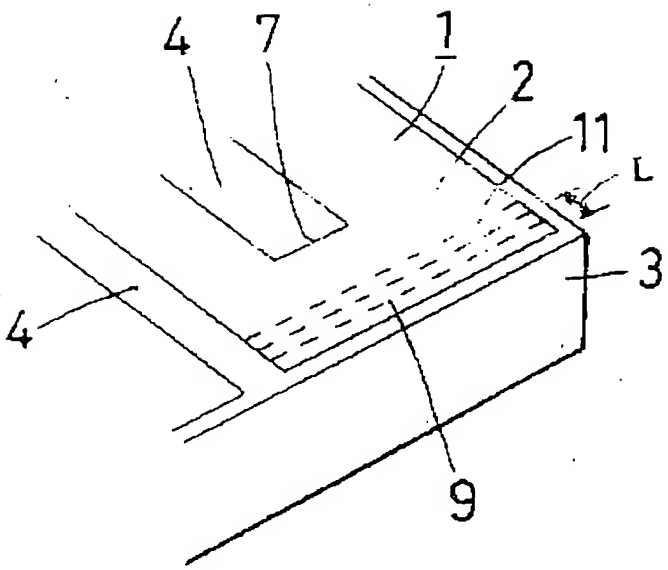
[Translation done.]

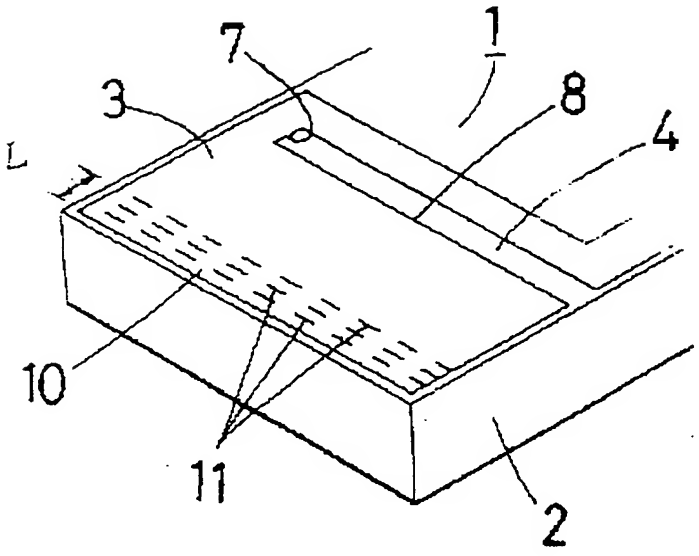
CLAIMS

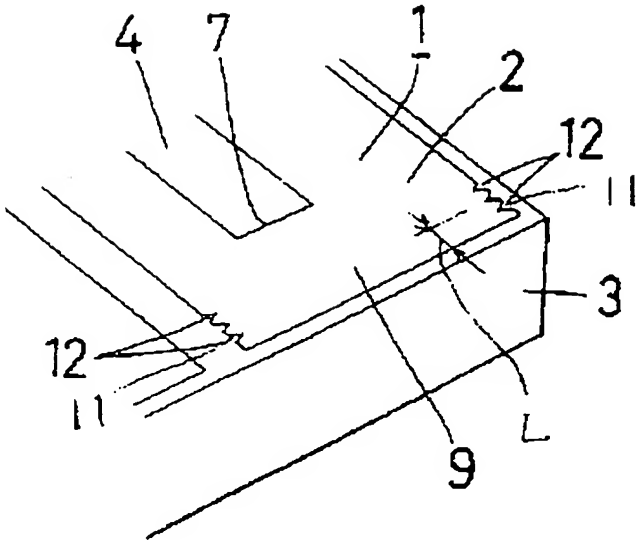
[Claim(s)]
[Claim 1] The reverse female mold antenna characterized by enabling it to adjust the resonance frequency of an antenna low by removing the metallic conductor of the outside side which counters the bottom of this slit in the reverse female mold antenna which prepares a metallic conductor on the surface of a dielectric, and has at least one slit in the metallic conductor.
[Claim 2] The reverse female mold antenna characterized by enabling it to adjust the resonance frequency of an antenna highly by removing the metallic conductor of the outside side which counters the flank of the above-mentioned slit in the reverse female mold antenna of the claim 1 above-mentioned publication.
[Claim 3] The reverse female mold antenna characterized by for the metallic conductor removed in the above-mentioned claim 1 and a reverse female mold antenna according to claim 2 in order to adjust the resonance frequency of an antenna having removed, and preparing a mark in a position more fixed than the outside side at the section.
[Claim 4] The reverse female mold antenna characterized by forming the mark which the metallic conductor removed and was formed in the section in the reverse female mold antenna of the claim 3 above-mentioned publication in the position which adjoined the outside side, and which countered two sides mutually to the minute slit.
[Claim 5] The reverse female mold antenna with which a minute slit is characterized by being formed intermittently in parallel with the outside side as MAMU in the above-mentioned claim 3 and a reverse female mold antenna according to claim 4.

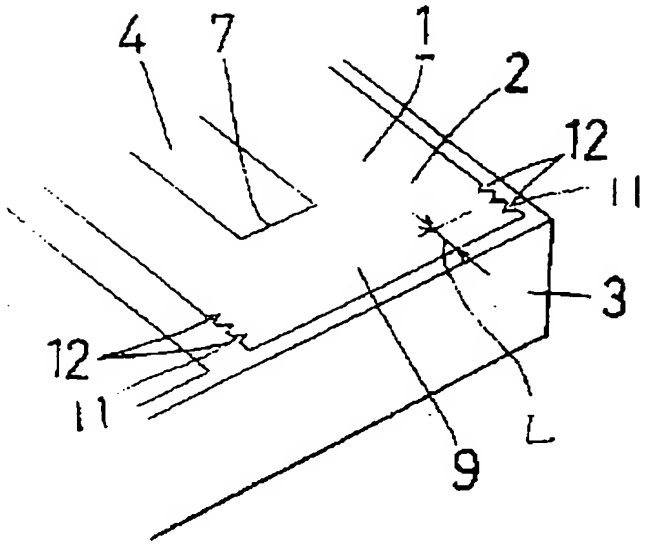
[Translation done.]


6
5
4
7
1
2
7
10
3
9
4
8


4
7
1
2
11
L
3
4
9


7
1
3
8
4
L
10
11
2


4
7
1
2
12
11
3
12
11
L
9


4
7
1
2
12
11
3
12
11
9
L